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LIGHTING DATA

EDISON LAMP WORKS
OF GENERAL ELECTRIC COMPANY

GENERAL SALES OFFICE

HARRISON, N. J.

The Lighting of Printing Plants



Information compiled by

A. D. BELL

Lighting Service Department

SYNOPSIS

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The Lighting of Printing Plants

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Introductory

The greatest medium to transmit the will of the human race is that of writing, for what is writing but the direct reproduction of mind or voice expression by means of symbols? On the pictorial side, views of nature, and human and mechanical actions are represented. In the 15th century this art of reproduction on paper by means of signs and symbols was advanced to a mechanical process and called printing.



Fig. 1. Night View of a Composing Room Lighted by 150-watt MAZDA C Lamps in Reflecto Cap Diffusers. One unit is located above each rack approximately 10 feet from the floor. This type of equipment gives exceptionally well diffused illumination and eliminates reflected glare

Since then it has progressed by gradual stages until it is now a very important industry, using highly developed machinery and much skilled labor.

The making and setting of the type and manipulation of the machines are human operations and hence require light. Daylight is the best but it is not always available. Construction of the plant may not allow sufficient light to reach all parts of it.

During the fall and winter seasons it becomes dark late in the afternoon and cloudy days and storms are likely to occur at any time during the year. Besides, many printing plants must operate at night. So the necessity of having a source of artificial light is obvious.

Present Practice

To maintain the high rates of operation and efficiency as characterized in the printing industry today one would expect to



Fig. 2. Night View of a Composing Room in a Large Daily Newspaper Plant. General illumination is supplied by 200-watt clear MAZDA C lamps in a simple type Duplexalite semi-indirect unit. The lamps are about 9 feet above the floor and on 12-foot centers. The light colored ceiling makes the system efficient and the character of illumination is very soft, evenly distributed and pleasing to work under

find in most plants a good lighting system. However, in many of them the systems are poor. In the smaller plants a great variety of units is found. In the first place the fixtures are located about the rooms to be lighted with no uniform scheme of hanging heights or spacing. Metal shades with 25- to 100-watt clear incandescent lamps hung on drop cords over the presses generally furnish most

of the illumination. Usually a few bare MAZDA lamps, either of 75 or 100 watts are found. The aisles and passages between rooms and presses may or may not have a few scattered units, generally in some form of enclosing globes. These conditions will be similar throughout the whole plant.

Nearly every worker, whether he be an engraver, compositor, press operator or bindery worker, has a unit which furnishes him with light adjusted to suit his own fancy. The drop cords are often adjusted by strings tied to them, which practice is entirely contrary to the Underwriter's lighting code. Often the lamps have paper fastened to them to give more of a shaded effect.

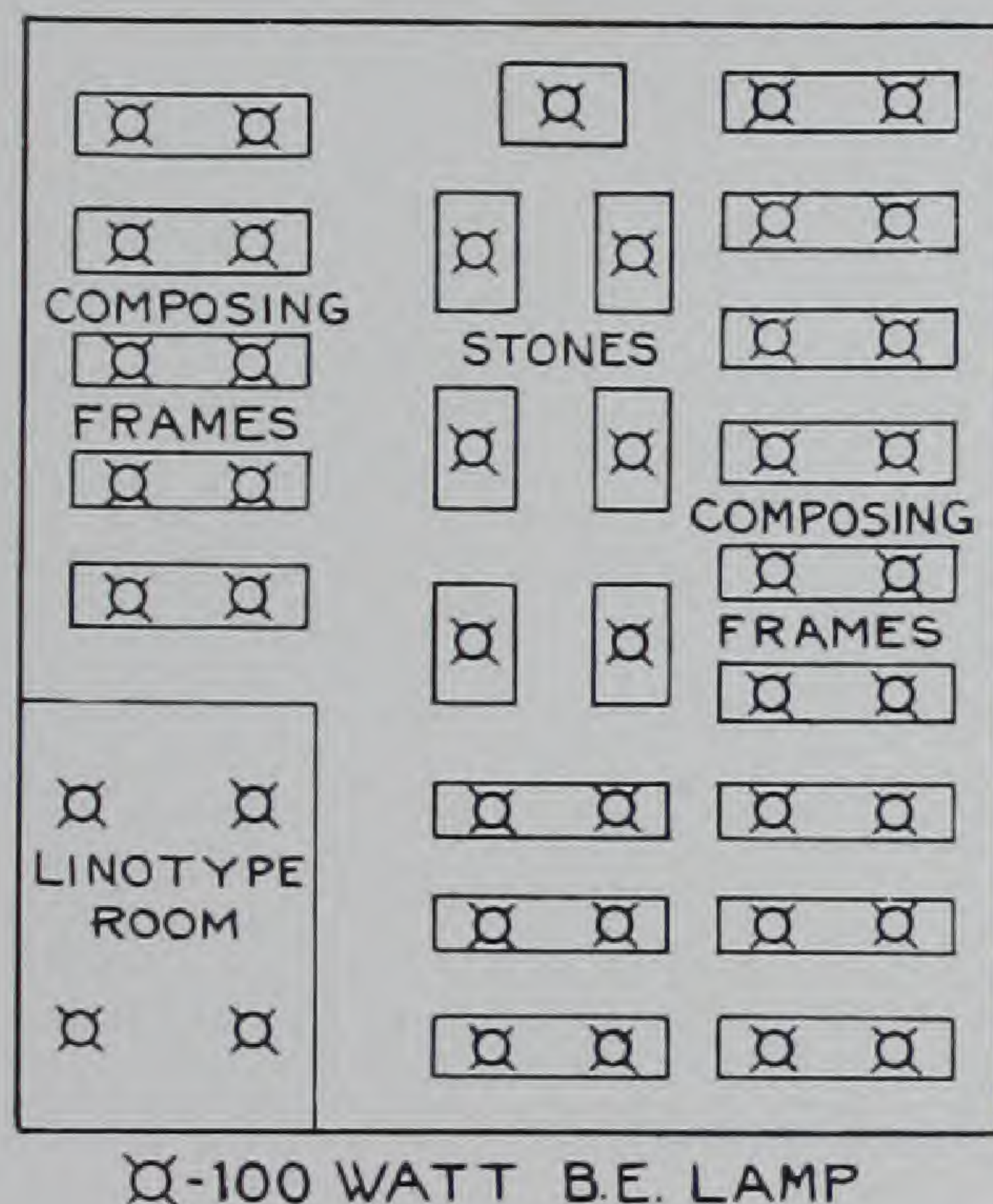


Fig. 3. Plan of a Typical Composing Room with a Recommended Lighting Layout

Such a layout is inefficient and costly. Individual drop lamps mean a big number of outlets, and outlets are expensive. An adjustable unit for each workman means that he is frequently going to spend a few minutes in making adjustments. This means time lost. Frequent handling also causes unnecessary breakage and wear of equipment.

In the larger plants the lighting is generally better. Frequently the publishers and printers of large and widely advertised publications have built new plants and have up-to-date lighting systems installed. On the other hand many printing plants of considerable size are the result of expansion. As they grew their lighting units were added in small numbers. A large variety of

fixtures have come out on the market and specimens of most of these can be found in many of the older plants. Hence, poor illumination has generally been the result. The owners and managers in many cases have tried to have their lighting sufficient for their needs but have failed simply due to the fact that they did not understand what good lighting was.



Fig. 4. Old Style Lighting. Can work be carried on efficiently under such conditions? There is a wide variety of equipment with no uniformity of hanging heights or spacing. Such reflectors as are employed do not sufficiently direct the light nor protect the eye. Glare is created, dense shadows and extreme contrasts result and the room appears generally untidy

Any mechanical or electrical system which is installed on a hit or miss basis usually gives poor results. This same idea likewise applies to a lighting installation installed in that manner.

General Requirements

The value of good lighting has been recognized in many industries and is becoming more so in the printing industry. Good lighting is not obtained from a lot of high wattage incandescent lamps hung indiscriminately about in a variety of reflectors. It is brought about by having the correct number of lamps hung in

suitable reflectors; units spaced and hung with reference to the size and surroundings of the room so that illumination of the proper intensity will be produced where it is needed.

Accidents in the printing industry may often be traced to the lack of sufficient lighting. The green workman may get his hands



Fig. 5. The Room Shown in Fig. 4 as it Appears by Night with Modern Lighting Equipment Installed. 200-watt MAZDA C lamps in reflector cap diffusers are hung about $13\frac{1}{2}$ feet above the floor on 16-foot centers. Dense shadows have been eliminated. The room is bright and cheerful, direct and reflected glare is a thing of the past and there is no question but that more and a higher grade product will result due to the improvement in lighting conditions

in a Gordon press or a foundry man may get burned with the hot metal used in the type casting if the lighting is poor. In the press rooms the aisles are often quite dark and a pressman in such a room may easily stumble. Such an accident may be serious if he is, for instance, carrying a heavy roll of paper. Good lighting throughout the plant will minimize the danger of accidents. More detailed information on this subject will be found in Bulletin Index 18, "Light and Safety."

It has been definitely proven that high level lighting makes possible great increases in production or output (see Bulletin

Index 17, "Light and Production"). This condition is particularly true in the printing plant where of necessity much work must be carried on under artificial lighting.

General illumination is the most satisfactory for a large part of the work in printing plants. It consists of having the whole room or working area uniformly lighted. This kind of lighting produces a bright and cheerful appearance. It is the nearest to daylight of any system. As the units are hung near the ceiling a wider distribution of light takes place and larger units can be used, thus decreasing the number of outlets and hence, cost.

When necessary to have an illumination of higher intensity in some particular place in the room this may be obtained by closer spacing of the units. In special cases local illumination can be furnished where necessary.

It is much easier to keep a room clean and in good order when it is well lighted. Spitting on the floor is an evil encountered in many places. This can be minimized if the room is well lighted, for any evidence of it will be shown up.

The different processes in the printing industry will obviously have special requirements. Type-setting, for instance, requires a higher intensity of illumination than the mechanical operation of a press. For color work, daylight MAZDA lamps or color matching units should be used. Each different process has to have its requirements handled separately.

While specific recommendations cannot be laid down so as to cover all cases, consideration should be taken of the following points:

1. Abundant and uniform illumination should be provided to prevent eye-strain.
2. Prevention of glare—usually by means of bowl enameled MAZDA C lamps with suitable reflecting equipment. Lighting units must be of such a character that the glare from glazed surfaces or paper will be prevented.
3. Workmen should not cast shadows on their work.
4. The system installed should be simple in arrangement and as low in cost as possible. However, good lighting should not be sacrificed for the sake of a small saving.
5. As few sizes of lamps as possible should be used. The lamps may become interchanged or it is possible that some one size may not be easily obtained when it is needed and hence uniform intensity of illumination will not result.

In order that the illumination be uniform the lamps have to be spaced and hung according to the size and height of the room. The greater the ceiling height, the greater the spacing of the units can be. However, as each floor is generally divided into bays by posts or columns the lamps will have to be hung according to the size of the bays. To simplify the construction and for the sake of appearance, the lamps should be spaced symmetrically with regard to the bays.

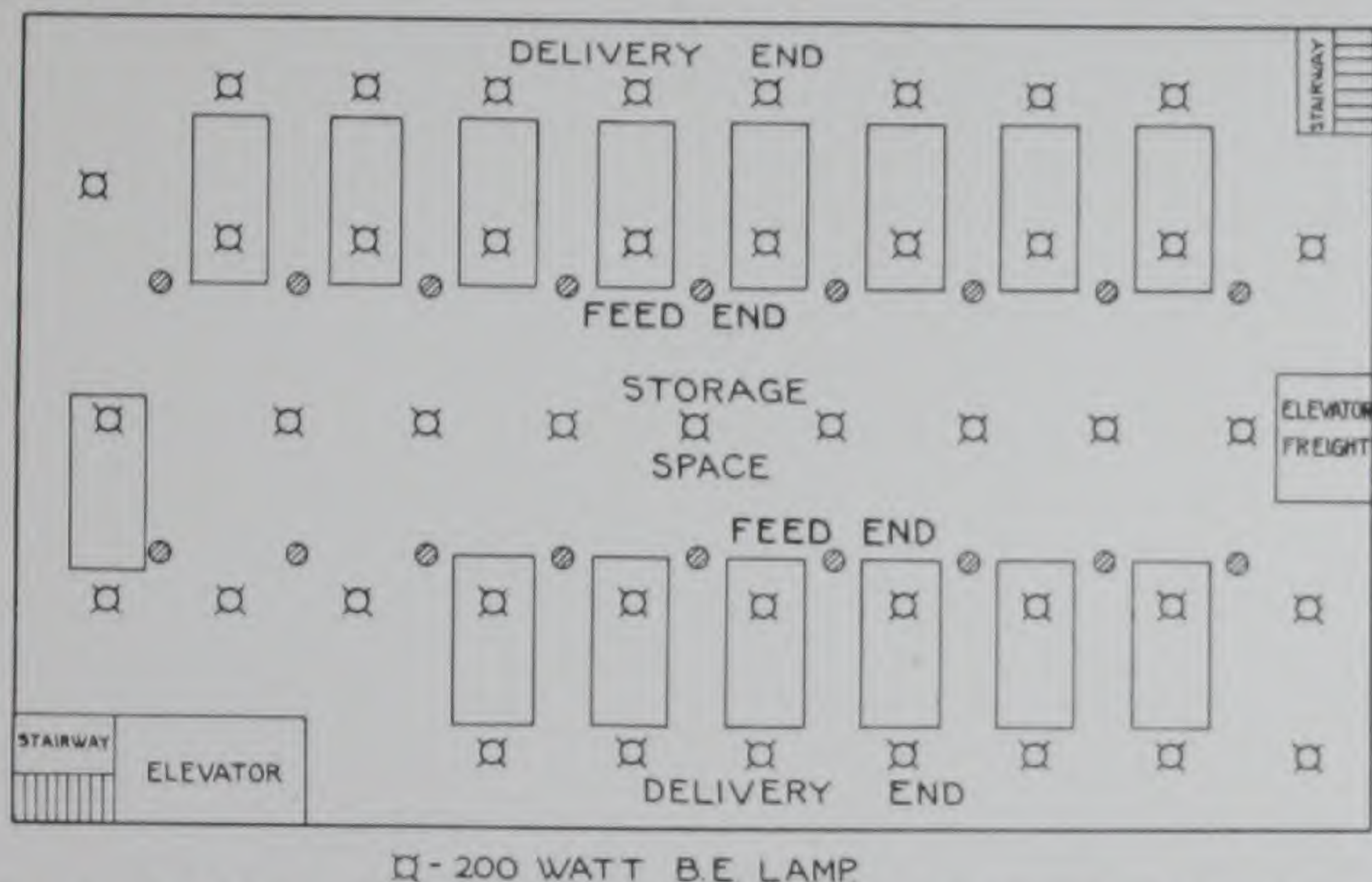


Fig. 6. A Lighting Layout of a Typical Press Room Equipped with High-speed Presses of the Rotary or Flat Bed Type. The position of lighting outlets indicated is such as to provide adequate illumination

Piping, sprinkler systems, etc., are usually found on the ceiling and if present in large numbers the shadow effect which would be produced by them should be considered. Printing presses are often high and project considerably out into the press room. Care should be taken in the location of the lighting units so that shadows from these do not fall on the work.

In printing establishments with large press rooms with large high-speed presses, the ceilings of the rooms directly below the presses vibrate considerably. Lighting units hung from such ceilings should be suspended by flexible drop cords rather than by rigid tubular piping.

MAZDA Lamps will stand small amounts of jar but intense vibration will materially shorten their lives; while the gentle swaying motion such as they would receive when suspended by a flexible

drop cord would not injure them in the least. Units suspended on flexible cords are especially convenient over high presses for they can be temporarily fastened to one side instead of being taken down in case it is necessary to move or repair the upper portion of the press.

With light colored walls and ceiling the light is well diffused and helps prevent dense shadows. The room presents a more cheerful appearance, is easier to keep clean and in good order. The finish on the machinery in press rooms is nearly always black. One large concern has its presses finished in white enamel (see Fig. 7) and the effect produced by them, together with white walls and ceiling, is very pleasing. Other plants could well have their presses finished in a similar manner. Bulletin Index 15, "Effect of Color of Walls and Ceilings on Resultant Illumination," gives some interesting data on this important phase of the subject.

As pointed out before, an incandescent lamp by itself is not a complete lighting unit. It is too bright for the eye to view and some means must be provided to shield the eye from the filament. It distributes its light equally in all directions and some device is essential to redirect the upward and side light downward to the work. For these purposes a reflector is used.

Reflectors of the RLM Standard Dome Steel enameled type are very satisfactory on account of their efficiency, durability, ease of cleaning and low initial cost. However, glass reflectors both of the bowl and the enclosing globe types are also used with very good results.

Bulletin Index 22 gives data on the properties of the various types of reflectors.

Type Making and Composing

It is the universal practice to illuminate the linotype and monotype machines by means of local lamps usually placed in half shades which generally throw the light on the proof and the keyboard. This does well enough but the rest of the room as a whole should be illuminated by a general system so as to provide an even intensity of from 5 to 7 foot-candles.

An evenly lighted room is much more satisfactory and it is more cheerful to work in, and can be kept cleaner and in better order than one where there are dark areas. Moreover, a bad condition for the eye is produced where one works in a small area of bright illumination surrounded by darkness.

In Fig. 3, the linotype room, general illumination is provided by 100-watt bowl enameled MAZDA C lamps in RLM Standard Dome Reflectors on centers 11 by 8 feet hung about 10 feet above the floor. A similar layout should be provided in rooms of other dimensions than the one shown.

In the main composing room, where all the work is done by hand, a system of localized general lighting should be employed.

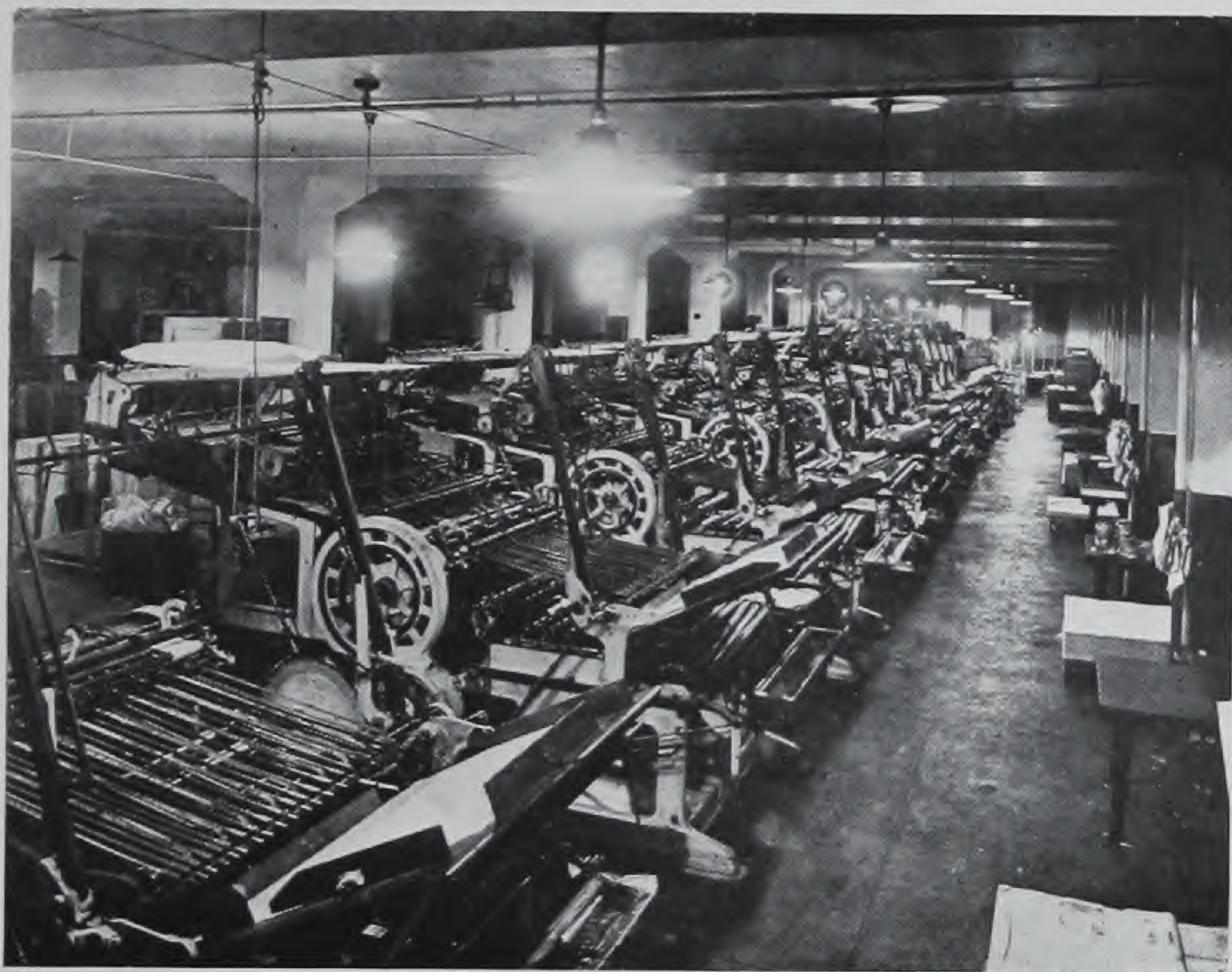


Fig. 7. The Press Room of a Large Publishing Concern as it Appears by Night Lighted by 150-watt Bowl Frosted MAZDA C Lamps in Porcelain Enameled Dome Steel Reflectors. These are hung 11 feet above the floor on centers 10 by 18 feet.

The localized general system recommended is followed out. It is interesting to note the application of white enamel paint to the presses creating excellent diffusion which tends to eliminate shadows and making the lighting system very effective

The work requires a very fine discrimination of detail, especially where the smaller varieties of type are used. Good lighting here is an especial asset, for errors will be eliminated, decreasing the necessity for changes in the proof, a costly and delaying process.

As racks are usually symmetrically spaced, an even distribution of illumination will be provided even though the localized general lighting scheme is followed. In the plan of a composing room (Fig. 3) two units, RLM Standard Dome Reflectors with 100-watt

bowl enameled MAZDA C lamps, hung at approximately 8 feet from the top of the frames, are used to light each rack. Such an installation will produce an intensity of approximately 12 foot-candles.

In the particular case shown and in the night views in Figs. 1 and 2, practically the entire room is devoted to composing frames and larger lamps on wider spaces might be employed, providing the ceiling was of sufficient height, say 15 feet, to allow for a spread of light. However, in most composing rooms, particularly in the

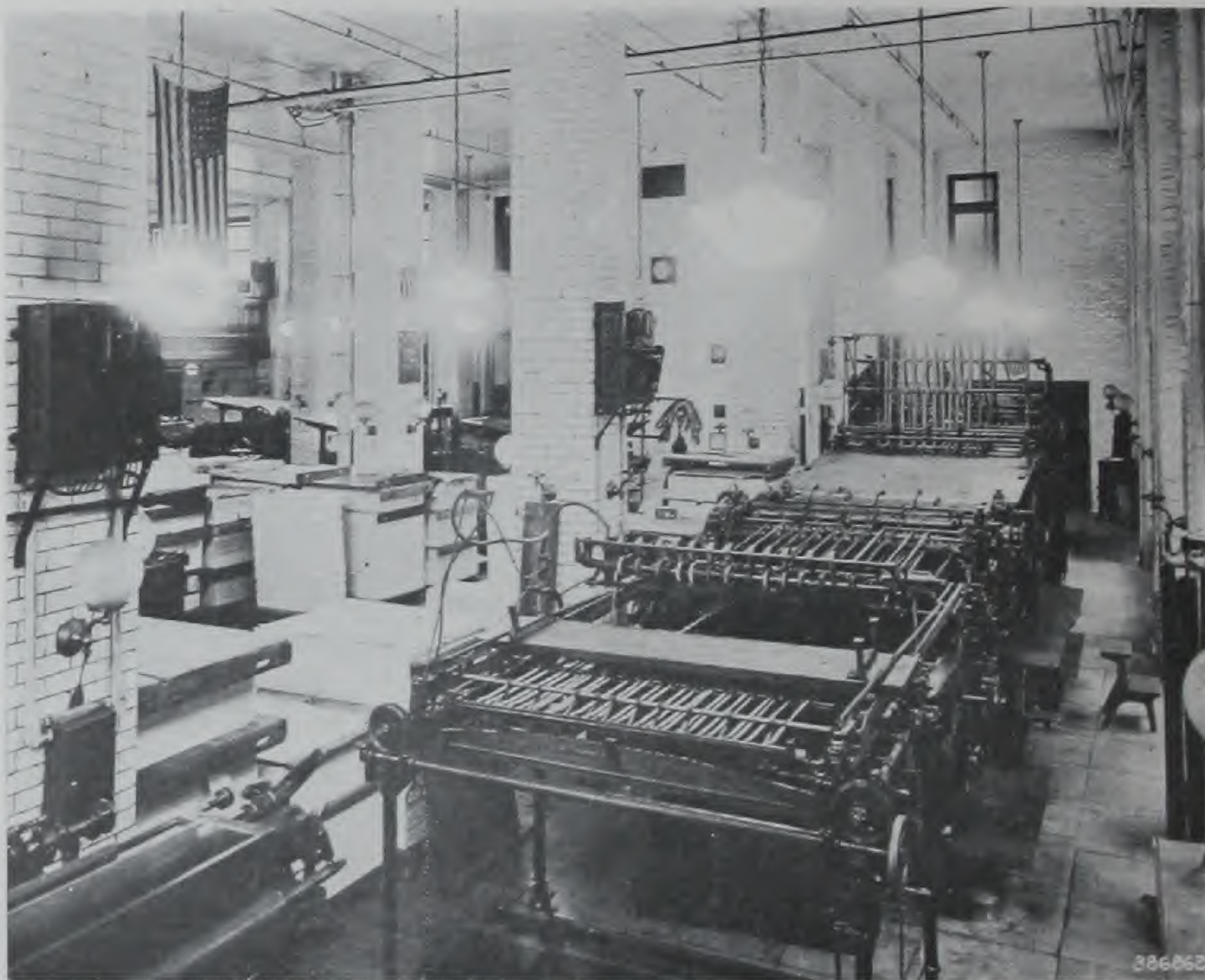


Fig. 8. General Illumination is Provided in This Press Room by 300-watt MAZDA C Lamps in Diffusing Opalescent Glass Enclosing Fixtures. These are 16 feet above the floor on 15-foot centers. The white tile side walls and the white ceiling make possible a high intensity of illumination throughout the room, and such a remarkable degree of diffusion that the necessity for local or trouble lamps in adjusting or repairing the press is minimized

smaller plants, in order to obtain the intensity of illumination where it is necessary, i.e., on the frames and stones, it would not be good economy to light the whole room to the high intensity. Hence, the localized general system of illumination is recommended as most universally applicable. The composing stones must also be properly lighted in order that the type may be accurately spaced and set. One similar unit (100-watt bowl enameled MAZDA C lamp in an RLM

Standard Dome Reflector) is recommended for each stone. It should be suspended over the center about 10 feet from the floor.

Photo-engraving

The illustrations used in a publication are printed from plates which are in general made by a process known as photo-engraving. In brief this consists of reproducing on sensitized metal plates, by photographic and chemical means, a sketch or drawing (known as a line cut) or a photograph (known as a half tone).



Fig. 9. The Press Room of a Job Printing Concern Where General Illumination is Successfully Applied. 100-watt daylight MAZDA lamps are used in semi-enclosing units. The lamps are approximately 10 feet above the floor on 10-foot centers. The quality of illumination is of material assistance for color work. It is interesting to note the individual pull chain controls on each outlet, permitting a special area to be illuminated as occasion demands

The photographic work requires a very high intensity of evenly distributed actinic light. High current open arc lamps with specially impregnated electrodes are used for this purpose.

After development work in a typical dark room the plates are etched or chemically treated. This work is usually carried on in the open and is not exacting in nature. A moderate intensity

(from 3 to 5 foot-candles) is adequate. General illumination employing fixtures which are not affected by chemical fumes should be supplied. Porcelain rather than brass shell sockets are to be preferred for such conditions as these.

The plates are inspected, the portions which are not desired are routed out or touched up with an engraver's tool, and are mounted on the wooden blocks. This work is carried on at tables or benches usually placed in a row near the windows. It is very important here that a light of a high intensity be provided on account of the minuteness of detail which must be observed. The work is usually planned so that most of it is done during the hours when natural light is adequate, yet on many occasions it must depend on the artificial illumination system. The methods of bench-lighting which have become standardized are applicable here. One hundred watt bowl enameled MAZDA C Lamps in bowl shaped steel or mirrored glass reflectors should be located on centers approximately 6 feet, from 6 inches to one foot from the front edge of the bench, approximately 5 feet above the bench.

Press Room

The next process after the composing is that of the actual printing itself. Most printing is done on one of the two main classes of presses—rotary and flat bed. In either case the paper is introduced into the feed end of the press and from there it is mechanically passed over the inked type and finally comes out at the delivery end in the desired printed form. It is important that the paper be properly fed into the press and the necessity of good lighting for this operation is obvious. It is likewise essential to have sufficient light at the delivery end to enable the operator there to watch the printed matter as it comes out to see whether it is satisfactory or not.

A suitable lighting unit placed over the ends of each press will provide the desired illumination. An example of such a layout is indicated in the plan Fig. 6; RLM Standard Dome Reflectors with bowl enameled MAZDA C lamps are especially suitable for this because they give a fairly wide distribution of light without glare, just where it is needed. As the presses are generally about 10 feet high it is necessary to hang the units high, and by using one unit over each end of the press the feed and delivery operations receive maximum light while there is sufficient spread of light to illuminate the remainder of the press and aisles, allowing any repairs or adjust-

ments to be made there. The effect of such a system of illumination will be seen in the night photos (Figs. 5 and 7.)

Both types of presses are generally arranged in rows and this will allow a symmetrical system of illumination to be laid out which will consist of two rows of lighting units along each row of presses. Thus a uniform intensity of illumination will be produced in the



Fig. 10. Night View of a Color Press Room Lighted by 200-watt Bowl Frosted MAZDA C Lamps in Prismatic Glass Reflectors, Hanging Height 12 feet, Space 16 by 16 Feet. The glass reflector transmitting some light tends to give the room a brighter, more pleasing appearance

vicinity of the presses. It is advisable also to provide both kinds of presses with an inspection lamp with a wire guard on an extension cord. This permits the necessary inspection or repairs within the interior in places where light from overhead sources would not penetrate.

In the case of small job presses, such as those of the Gordon type, an intensity of at least 8 foot-candles is recommended, using a system of general illumination with RLM Standard Dome Reflectors and bowl enameled MAZDA C lamps. This would be obtained from the following arrangement provided surroundings are light in color:

- With ceilings under 12 feet.....100- or 150- watt
 MAZDA C lamps on 9- or 11-foot centers respectively.
 Ceilings 12 to 16 feet.....200-watt MAZDA C lamps
 on 13-foot centers.
 Ceilings above 16 feet.....300-watt or 500-watt Mazda
 C lamps on 16- or 20-foot centers respectively.

Examples of symmetrical or general lighting of presses with light walls and ceilings where adequate hanging heights are possible are to be observed in Figs. 8, 9, and 10.



Fig. 11. Bindery, Well Illuminated by 100-watt MAZDA C Lamps in Deep Bowl Mirrored Glass Reflectors. This unit is efficient in redirecting the light and therefore gives excellent illumination with a minimum expenditure of power. Although no light is transmitted by the glass ware, the surroundings are light colored, preventing the room from having a gloomy appearance

Color press work is becoming an important branch of the printing industry. It varies from the simple two color work to the rather more complicated multiple printing in common lithography. The proper alignment of plates and accurate press work is a most important element in successful color printing. In view of the huge production required on many jobs in a short time it is impor-

tant to employ every possible aid to insure accurate printing. As indicated, good lighting is an essential element to maximum production for any sort of printing. This is especially true in color press work where color accuracy is required and hence more careful inspection must be made.

The general schemes outlined for the press room apply for color work, save that it is desirable to employ daylight MAZDA lamps as pointed out in Bulletin Index 3, "Artificial Daylight for Merchandising and Industry." The daylight MAZDA lamp is

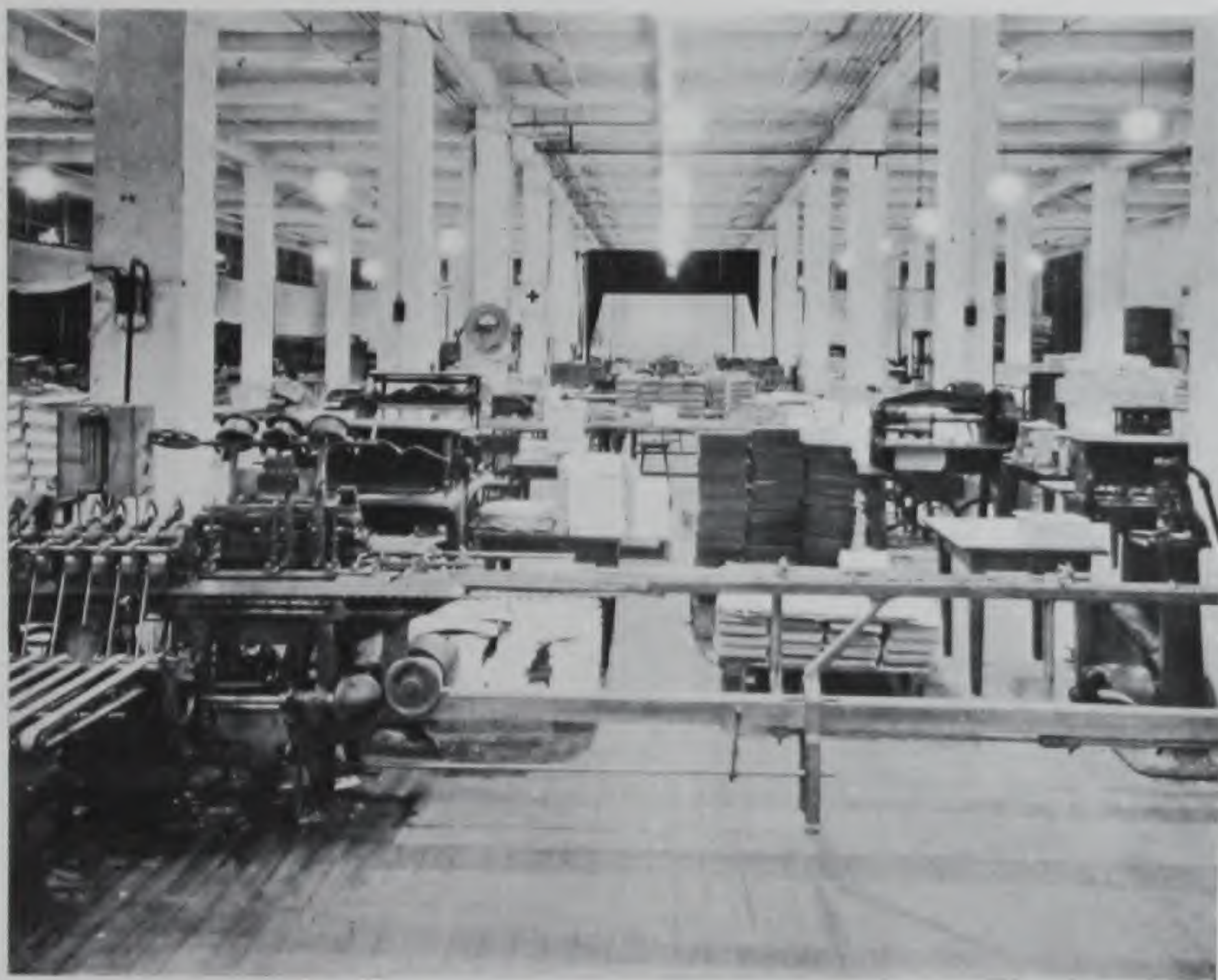


Fig. 12. The Bindery in a Large Commercial Printing Establishment Illuminated by 150-watt Bowl Frosted MAZDA C Lamps in Prismatic Glass Reflectors 12 Feet Above the Floor. One unit at the center of each 16-foot bay. This is an illustration of strictly general illumination and is suitable for such work. The excellent paint treatment and general cleanliness add materially to the usefulness of the lighting

provided with a scientifically blue glass bulb, while the filament is run at a higher temperature, giving a whiter light than that produced by the regular MAZDA C lamp. The blue bulb does not add anything to the color of the light but subtracts a certain percentage of the rays which are predominant in the unmodified light. This fact must be borne in mind when installing daylight MAZDA

lamps and, in order to obtain the same illumination, it will be necessary to use approximately 35 per cent higher wattage than when clear MAZDA C lamps are installed. In other words, a sacrifice in quantity is made to obtain color quality.

It is readily recognized that it is difficult to detect a yellow half tone from the white background when illuminated with the regular MAZDA lamps. It is also particularly hard to detect blues and blacks, and other colors are not shown in their true relation. The claim is not made that the daylight MAZDA lamps produce accurate north light, but the improved quality is of a decided advantage in the hurried inspection of the work as it comes from the press. They are also of material assistance in the artist's workshop.

There are accurate types of color matching units which employ clear MAZDA C lamps in a suitable reflector and filter the light through a very carefully determined blue glass plate. This type of unit produces unvarying light of north sky light quality. Its total output, however, is not sufficient to warrant its use for general illumination. This accurate type of color matching unit, however, is particularly adaptable to the final inspection and for the absolute assurance of night work. By having the room generally illuminated by daylight lamps and one or more of the accurate type of color-matching units over the inspection bench, overcast days and nightfall put no check on the art or press work in a lithographing plant.

The preparation of the stones and plates for lithography and photogravure demands lighting similar to that suggested for the hand work and retouching on photo-engraved plates. The localized general system of illumination employing RLM Standard Dome Reflectors and bowl enameled Daylight MAZDA lamps gives excellent results.

By the use of diffusing semi-enclosing globes with clear daylight MAZDA lamps a high intensity of well diffused light is produced which will assist materially in maintaining the standard of production.

Bindery

In the bindery the printed matter is collected and prepared for distribution. Magazine and book material is usually printed in large sheets and these have first to be cut and then trimmed to the size of the publications for which they are intended. The other operations of folding, punching, stitching, covering, etc.,

follow depending upon the variety of work being done. Although these operations, as illustrated in Fig. 12, are largely done by machines which are supervised and controlled by hand, it is essential that accuracy be maintained, for irregularly cut, punched or stitched sheets cause a very inferior product. It is also important to note that this kind of work is done largely by women and girls who by nature are sensitive to their working conditions and well lighted, cheerful surroundings are especially appreciated by them. It tends to increase their efficiency and makes them more contented.

Safe operation of the cutting and trimming machines demands proper lighting. With glaring or inadequate lighting here an operator can easily be seriously maimed.

A system of general illumination will be satisfactory, provided an average lighting intensity of at least 5 foot-candles is furnished.

In the gathering machines it is often advisable to install local MAZDA B lamps with wire guards around them in order that adjustments and repairs can be easily made. Such lamps should be of the Mill type in order to withstand the vibration. They are available in 25 and 50 watt sizes.

RLM Standard Dome reflectors with bowl enameled MAZDA C lamps are satisfactory equipment to produce the desired general illumination. To produce an approximate average of 5 foot-candles intensity the following specifications are given:—

Ceiling below 12 feet—100 watt, MAZDA C Bowl enameled lamps on 12 foot centers.

Ceiling 12 to 16 feet—150 watt, MAZDA C Bowl enameled lamps on 12 or 13 foot centers.

Ceilings above 16 feet—200 watt, MAZDA C Bowl enameled lamps on 14 or 15 foot centers.

The importance of good illumination for neat and careful work such as the covering of books and folders is shown in Fig. 11.

Conclusion

A lighting installation may be of the best, but unless there is a regular system of cleaning and maintenance, it will soon lose its efficiency. Lamps gradually blacken and burn out as their period of life decreases. It is good economy to replace badly blackened lamps even though they have not burned out, as the light output is relatively small. Lighting units collect dirt and dust and a

dirty reflecting surface gives very poor results, soon making the lighting practically useless. Very interesting and much more detailed data on the subject of cleaning and maintenance may be found in Bulletin Index 14, "The Maintenance of the Lighting System."

The attempt has been made to cover the principal processes encountered in the industry. Other phases of the work have lighting demands which are not widely variant from those found in other fields of activity—for instance, proof reading and the preparation of text material necessitates illumination of the order which would be needed for high grade office lighting. (See Bulletin Index 35, "The Lighting of Office Buildings and Drafting Rooms.") The machine shop requires lighting of a type described in Bulletin Index 62, "The Lighting of Machine Shops."

The methods which have been recommended for the various operations are based on actual installations in a variety of printing establishments and have given entire satisfaction. Different plants naturally have special problems due to construction of the buildings, location of the machinery, etc. The systems outlined may be suitably adapted and applied so as to give successful results in any plant, provided due consideration is given such items as shadow effects, direct and reflected glare, uniform distribution and the like.

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are located in all the principal cities
of the United States*

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